PATENT SPECIFICATION

297,158

Application Date: June 23, 1927. No. 16,672/27.

Complete Left: March 15, 1928.

Complete Accepted: Sept. 20, 1928.

PROVISIONAL SPECIFICATION.

Improvements in Hydraulic Absorption Apparatus for the Generation of Heat.

We, HEENAN AND FROUDE LIMITED, of Worcester Engineering Works, Worcester, County of Worcester, a British company, and GEORGE HENRY WALKER, Engineer with the said company, a British subject, do hereby declare the nature of this invention to be as follows:—

This invention relates to improvements in hydraulic absorption apparatus for the generation of heat.

In the destruction of power by means of a hydraulic absorption apparatus heat is generated and is imparted to the circulating water or other liquid with which the brake is supplied and it has been proposed to store the resulting hot water or steam in a closed vessel, known as a heat accumulator, from which it can be withdrawn for use as required. It has also been proposed to connect the hydraulic absorption apparatus or heat generator by means of piping or other passages to the heat accumulator so that a circulation of water between the two units of the apparatus may be permitted.

A difficulty connected with the practical application of such schemes lies in the method of regulating the consumption of power to suit that which is available at the shaft of the hydraulic absorption apparatus. Conditions may arise in which the amount of power consumed by the hydraulic absorption apparatus if allowed to develop full resistance to rotation would be in excess of the power supplied so that the speed of the shaft would fall, to the detriment of the efficiency of other parts of the system.

The object of the present invention is to provide a simple and efficient method of regulating the power consumption which will meet the above mentioned conditions.

In hydraulic absorption apparatus there usually exists a vortex or vortices at the centre of which exists a low pressure and at the outer diameter = high pressure.

In the prior Specification No. 24,949 of 1910 of Heenan and Froude Limited and Harrison means are described for admitting to the centre of the vortices air under atmospheric pressure, which means consisted of holes or pipes communicating between the external atmosphere and the parts of the hydraulic absorption apparatus corresponding with the centre of rotation of the vortices.

According to the present invention use is made of similar passages which, however, while communicating with the centre of the vortices, are connected by piping or other passages with the steam space existing in the heat accumulator, with which the hydraulic absorption apparatus is connected, and not to external atmosphere. The water inlets and outlets of the hydraulic absorption apparatus are coupled up respectively with the water space of the heat accumulator so that water can be drawn away by circulating pump or by a natural fall from one portion of the accumulator, and after passing through the hydraulic absorption apparatus can be discharged into another portion of the same vessel.

A valve is fixed on the water outlet of the hydraulic absorption apparatus controllable by hand or automatically as by a governor, and if desired a further valve controlling the water inlet of the brake may be connected to the same governing system so that a flow of water out of or into the brake may be regulated.

By limiting the amount of water entering the hydraulic absorption apparatus at a point near the centre of the vortices and simultaneously giving the water at exit from the machine a free passage, the vortices are allowed to cavitate, and the amount of water in the machine may be reduced to almost nil without interfering with the whirling motion of the water, so that of power consumed is a minimum.

Alternatively, by admitting water through the inlet valve to the machine and choking its exit the vortices may be caused to fill up and the amount of power can be made a maximum at the particular speed of rotation existing. Intermediate stages between these limits can be obtained by regulation of the valves. Or, alternatively, the inlet valve may be hand-operated and the outlet valve automatically operated with a similar result.

If will be apparent that if the centre of the vortices had been allowed to communicate with the external atmosphere

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this system of regulation would not be practicable owing to the fact that the pressure of steam and water in the heat accumulator, for efficient operation, would have to be maintained at a high level and both would consequently escape into external atmosphere through the ports described as air passages in the previous Specification No. 24,949 of 1910. On the other hand fluid of considerably less density than water must have free entry to the centre of the vortices otherwise the pressure of water in the hydraulic absorption apparatus would prevent cavitation from taking place, and regulation of the power consumed could not be performed without considerable extra complication. The use of steam at substantially the same pressure as that which exists in the water inlet piping of the hydraulic absorption apparatus renders practicable the system of power control herein described.

Dated this 22nd day of June, 1927.
J. OWDEN O'BRIEN,
late W. P. Thompson & Co.,
of Manchester,
Patent Agent.

COMPLETE SPECIFICATION.

Improvements in Hydraulic Absorption Apparatus for the Generation of Heat.

We, HEENAN AND FROUDE LIMITED, of Worcester Engineering Works, Worcester, County of Worcester, a British company, and GEORGE HENRY WALKER, Engineer with the said company, a British subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in hydraulic absorption apparatus for the generation of heat.

In the destruction of power by means of a hydraulic absorption apparatus heat is generated and is imparted to the circulating water or other liquid with which the apparatus is supplied and it has been proposed to store the resulting hot water or steam in a closed vessel, known as a heat accumulator, from which it can be withdrawn for use as required. It has also been proposed to connect the hydraulic absorption apparatus or heat generator by means of piping or other passages to the heat accumulator so that a circulation of water between the two units of the apparatus may be permitted.

A difficulty connected with the practical application of such schemes lies in the method of regulating the consumption of power to suit that which is available at the shaft of the apparatus. Conditions may arise in which the amount of power consumed by the hydraulic absorption apparatus if allowed to develop full resistance to rotation would be in excess of the power supplied so that the speed of the shaft would fall, to the detriment of the efficiency of other parts of the system.

The object of the present invention is to provide a simple and efficient method of regulating the power consumption which will meet the above mentioned conditions.

In hydraulic absorption apparatus there usually exists a vortex or vortices at the centre of which exists a low pressure and at the outer diameter a high pressure and in the prior Specification No. 24,949 of 1910 of Heenan and Froude Limited and Harrison means are described for admitting to the centre of the vortices air under atmospheric pressure, which means consisted of holes or pipes communicating between the external atmosphere and the parts of the hydraulic absorption apparatus corresponding with the centre of rotation of the vortices.

According to the present invention the steam space existing in a heat accumulator is connected with the interior of the hydraulic absorption apparatus at a point or points at or near the centre of the vortex or vortices where, under running conditions, the pressure is relatively low.

Such connection to the point or points at or near the centre of the vortex or vortices may be made by passages formed in the vanes of the power absorbing elements in a manner similar to that described in the prior Specification No. 24,949 of 1910 and these passages are connected by a steam pipe with the steam space in the heat accumulator instead of being connected to the external atmosphere. The water inlets and outlets of the hydraulic absorption apparatus are both coupled up through a suitable valve or valves with the water space of the heat accumulator so that water can be drawn away by a circulating pump or by a natural fall from one portion of the accumulator, and after passing through the hydraulic heat generator can be discharged again into the accumulator.

The invention will be described with

reference to the accompanying drawings.

Fig. 1. Diagrammatic view of the heat generator, heat accumulator and other accessories.

Fig. 2. Horizontal section through the hydraulic heat generator.

Fig. 3. Enlarged section on line 3—3 Fig. 2 showing the passages through the vanes of the power absorbing element connecting the steam pipe to the centres of the vortices.

Fig. 4. Detail sectional view of distributing valve controlling the flow of water to and from the heat generator and the heat accumulator, the valve being set for minimum load.

Fig. 5. Detail sectional view of the distributing valve, the valve being set for maximum load.

Fig. 6. Diagrammatic view of hydraulic heat generator showing an alternative arrangement of valve control.

The hydraulic heat generator A is similar to that described in Specification No. 24,949 of 1910 with a rotor B mounted on the shaft B^1 driven from a suitable prime mover and a stator C. Passages c are formed in the vanes of the stator C connecting the points corresponding to the centres of the vortices with the annular spaces c^1 and these annular spaces c^1 are connected by the steam pipe D with the steam space e at the top of the heat accumulator E. An isolating or regulating valve d may be arranged in the steam pipe D whereby the flow of steam from the heat generator A to the heat accumulator E or vice versa may be shut off or adjusted.

Passages c^2 are also formed in the vanes of the stator C connecting the water spaces between the vanes with the annular space c^3 and this annular space c^3 is connected to the water inlet passages F^1 arranged one at either side of the generator and terminating in a single passage or pipe F. The water outlet pipe G is connected to the annular space B^2 surrounding the rotor B. The water inlet pipe F and the water outlet pipe G are connected to the water space c^1 of the heat accumulator E through a distributing valve H controlled by an actuating rod K from a suitable governor (not shown in the drawings) so that the flow of water into and out of the generator is regulated and the power consumed in the heat generator is adjusted. Thus for example, when the water is admitted freely to the heat generator, and the outlet valve is almost closed, the power absorbing elements are packed full of water and the power consumed is the maximum. On the other hand, when little or no water is admitted to the heat generator and the outlet valve is wide open, the water has a free passage from the heat generator, which by virtue of its rotation and the centrifugal force imparted to the water, can empty itself or nearly so, and in these circumstances the power consumed is a minimum. Intermediate positions of the valves result in intermediate powers being absorbed.

A circulating pump J which may be of the motor-driven centrifugal pattern is preferably employed in the circulating system so that the pressure of water supplied to the inlet F of the heat generator A may be raised in excess of that due to the difference in head between water level in the heat accumulator E and that in the heat generator A. By means of suitably arranging the valves or the ports of the distributing valve, the pump suction instead of drawing water from the accumulator may, upon occasion, be put into communication with the outlet G of the heat generator and the pump discharge may be connected to the accumulator E thus enabling the pump to extract water from the heat generator and so nearly or entirely draining it and reducing the power consumed to almost nil.

A suitable balanced distributing valve for controlling the flow of water is shown in Figs. 4 and 5, the setting shown in Fig. 4 being for the minimum load and the setting shown in Fig. 5 being for the maximum load. The valve is formed with six ports, the port h^1 connected to the water inlet F of the heat generator, the port h^2 connected to the water space c^1 of the heat accumulator E, the port h^3 connected to the suction side of the circulating pump J, the port h^4 connected to the bottom of the water space of the heat accumulator E, the port h^5 connected to the water outlet G from the heat generator A and the port h^6 connected to the discharge side of the pump J. The actuating rod K is formed with several pistons k^1, k^2, k^3 and k^4.

When the valve is set for the minimum load as in Fig. 4 the port h^4 is cut off from the port h^3 by the piston k^3 and consequently the feed from the accumulator is choked, the port h^5 connected to the water outlet G from the heat accumulator A is in communication with the port h^3 connected to the suction side of the pump J and the port h^6 connected to the discharge side of the pump J is in communication with the port h^2 connected to the water space c^1 of the heat accumulator E so that the pump J is drawing water from the water outlet G of the heat generator A and delivering it to the heat accumulator E. The port h^1 connected to the inlet F of the heat generator A is choked by the

piston k^1 so that water is not passing into the generator.

When the valve is set for the maximum load the actuating rod K has moved into the position shown in Fig. 5 so that the port h^4 connected to the water space e^1 of the heat accumulator is in communication with the port h^3 connected to the suction side of the pump J, the port h^5 connected to the outlet G of the heat generator H is closed by the piston k^3, the port h^2 connected to the heat accumulator E is choked by the two pistons k^2 and k^3 and the port h^6 connected to the discharge side of the pump A is in communication with the port h^1 connected to the water inlet F of the heat generator A. The pump J is thus drawing water from the accumulator E and discharging it to the water inlet F of the heat generator whilst the water outlet G from the heat generator is choked.

The actuating rod K on which the pistons k^1, k^2 k^3 and k^4 are mounted is connected through link gear or any other convenient manner to the governor which may be of the centrifugal or other pattern, arranged so that any tendency of the heat generator and prime mover to increase their speed, automatically increases the power consumed by the heat generator, while any tendency for the speed to fall has a contrary effect.

Suitable isolating valves may be arranged in the pipes. Thus the valves f, g are arranged between the heat generator A and the distributing valve H, the valves j; j^1 between the valve H and the pump J, the valves e^2, e^3 between the valve H and the heat accumulator E, the valve d in the steam pipe D.

Instead of a distributing valve H as described above the water inlet F and the water outlet G of the heat generator A may be each provided with a separate valve F^2, G^2 as shown in Fig. 6. These valves F^2 and G^2 as shown, are of the butterfly type, but any other suitable balanced type may be employed. They are connected together by link gear M or in any other convenient manner so that as one valve opens the other closes. The link gear M is connected to an actuating rod K connected to the governor (which is not shown in the drawing).

The steam pipe D may be enclosed within a pipe of larger diameter which outer pipe may be employed to convey the heated liquid from the casing of the heat generator A to the accumulator E. This avoids condensation of steam which, under certain conditions, may interfere with the effective operation of the heat generator. Alternatively the steam pipe may be efficiently lagged with heat insulating material for the same purpose.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In an hydraulic absorption apparatus for the generation of heat the combination with an hydraulic absorption apparatus of a heat accumulator, the steam space in which is connected with the interior of the hydraulic absorption apparatus at a point or points at or near the centre of the vortex or vortices set up therein, where under running conditions the pressure is relatively low.

2. An hydraulic absorption apparatus for the generation of heat, comprising an hydraulic absorption apparatus and a heat accumulator the steam space in the heat accumulator being connected with the interior of the hydraulic absorption apparatus at a point or points at or near the centre of the vortex or vortices set up therein, where under running conditions the pressure is relatively low and the water space in the heat accumulator being connected respectively with the water inlet and the water outlet of the hydraulic absorption apparatus substantially as described.

3. An hydraulic absorption apparatus for the generation of heat as in Claim 2 having a circulating pump and a suitably balanced distributing valve controlled by a governor substantially as described.

4. An hydraulic absorption apparatus for the generation of heat as in Claim 2 having balanced valves in the water inlet and outlet of the absorption apparatus, the said valves connected together so that one will open as the other shuts and controlled by a suitable governor substantially as described.

5. Hydraulic absorption apparatus for the generation of heat having passages through the vanes of the power absorbing elements connecting the centres or approximately the centres of the vortices formed therein with the steam space of a heat accumulator substantially as described.

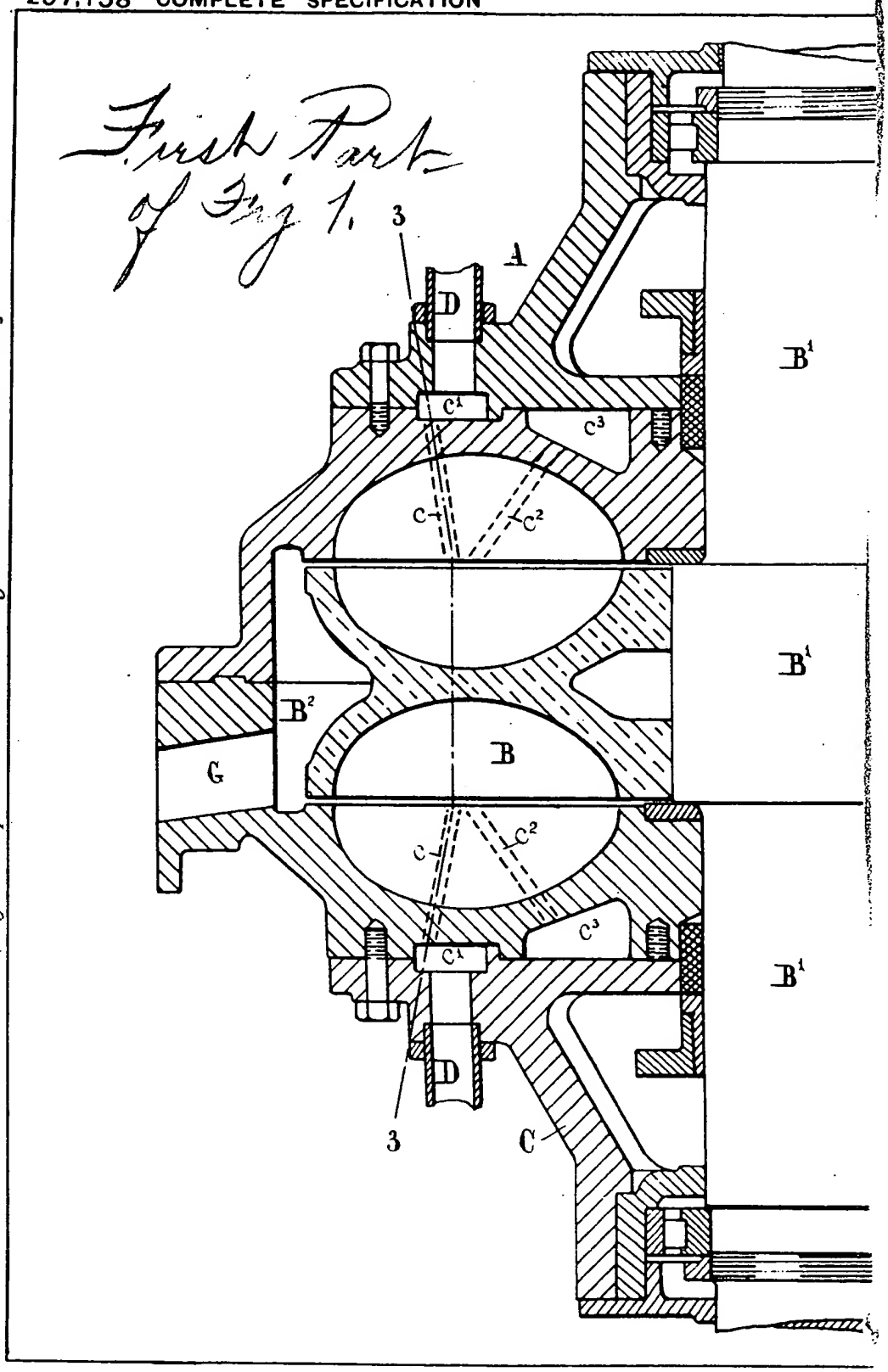
6. A hydraulic heat generating system as a whole substantially as described with reference to the accompanying drawings.

Dated this 7th day of March, 1928.

J. OWDEN O'BRIEN,
late W. P. Thompson & Co.,
of Manchester,
Patent Agent.

297,158 COMPLETE SPECIFICATION

[This Drawing is a reproduction of the Original on a reduced scale]



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2 SHEETS
SHEET 1

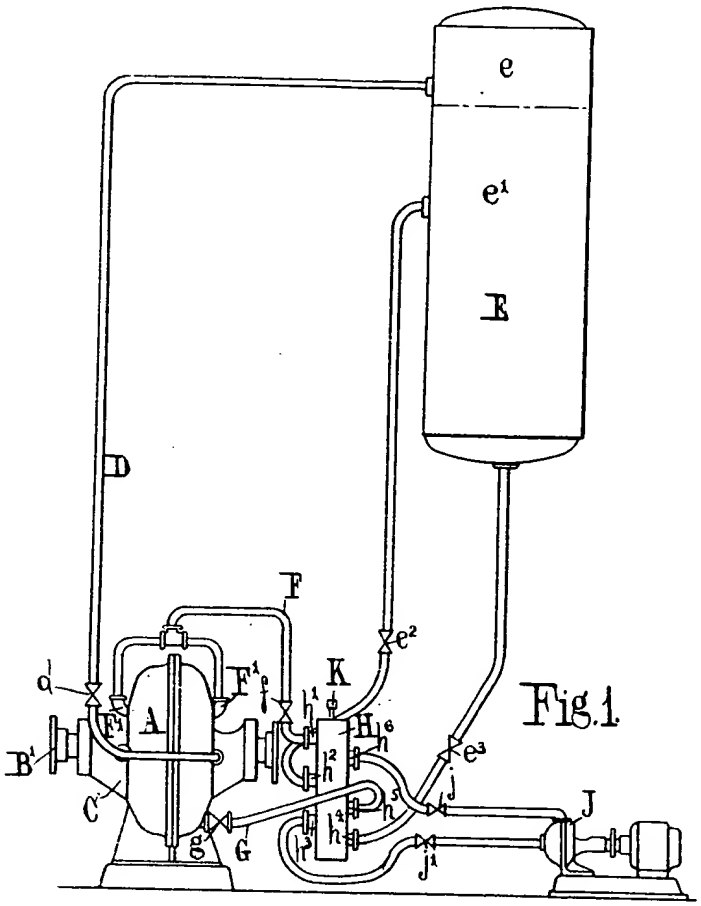

Fig.1

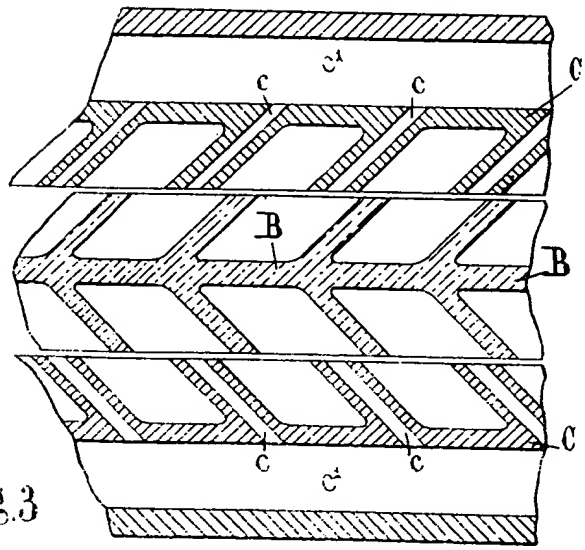

Fig.3

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2 SHEETS
SHEET 2

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Second Part.

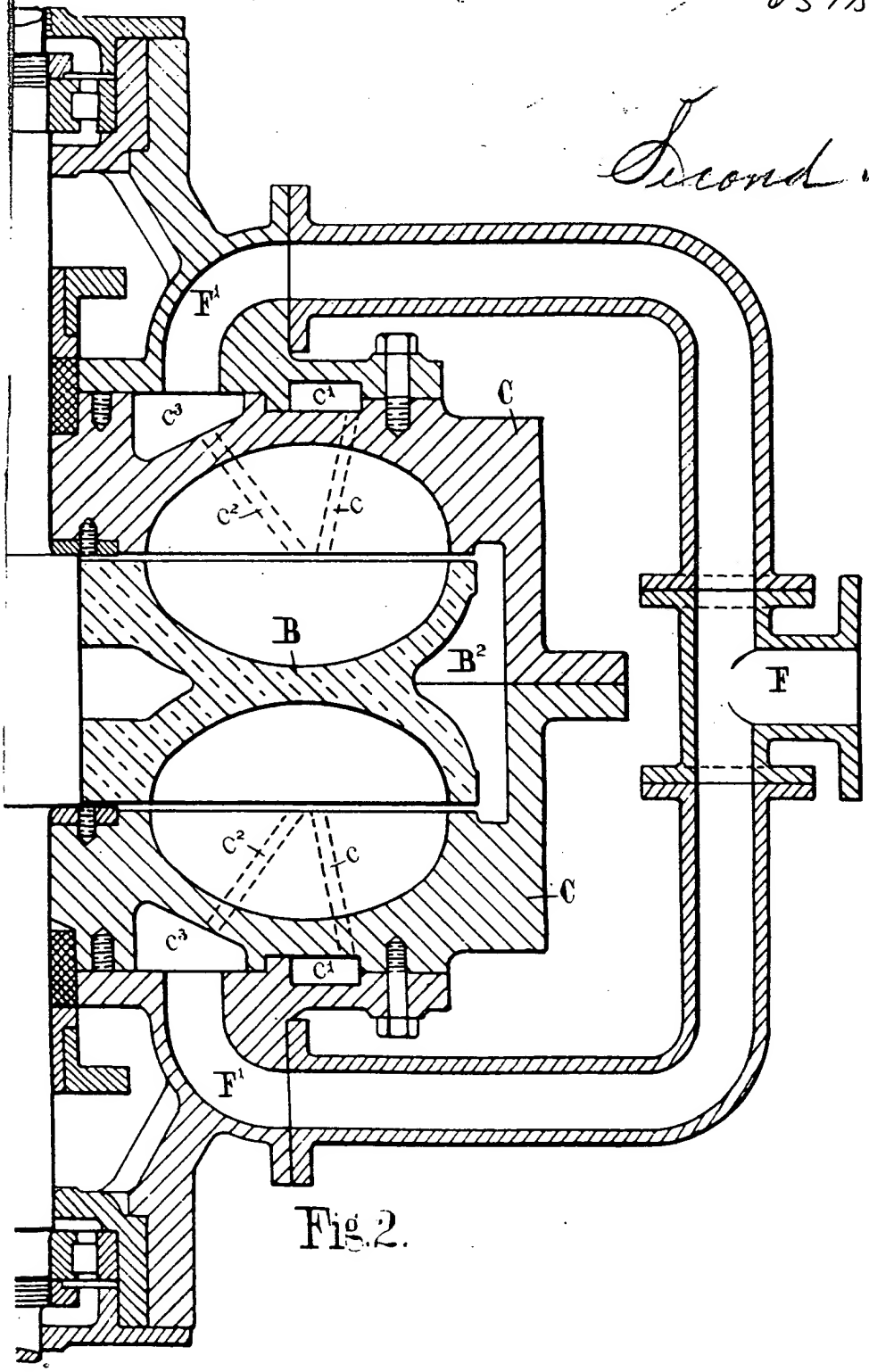

Fig. 2.

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